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The Contribution of Low Rank Coal Liquefaction in Indonesian Economy in 2025

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Abstract

One of the objectives of the Indonesian National Energy Policy (KebijakanEnergiNasional – KEN) as outlined in Presidential Decree (Perpres) No. 5/2006 is the realization of an optimal energy mix by the year 2025, which includes reducing oil consumption to 20% and increasing the utilization of coal to more than 33%. KEN also mandates that 2% of national energy needs be sourced from the liquefaction of coal.

This study also aims to analyze the economic impacts and intersectoral linkages based on the Indonesian Input-Output Table for the year 2005 which is projected to 2025 by including the low-rank coal synthetic oil (CSO) sector as a new classification. Econometric models (regression analysis) and linear programming are applied for this study.

Results from economic analysis found that with an assumed coal price of US\$60/ton, CSO selling price of US\$111/bbl and interest rate (i) of 5%, investment in CSO plants will give an Internal Rate of Return (IRR) of less than 10%. Backward linkage analysis found that the CSO sector has the potential to generate more yield for the economy than other energy sectors, but also a lower rate of forward (downstream) linkage. Multiplier analysis, on the other hand, found that the development of CSO plants is capable of driving other sectors of the economy equal to the petroleum refining sector and other energy providers, albeit with a lower business surplus. The government needs to give incentives for the effort, such as through regulatory and financial support, tax incentives/tax holidays, price subsidies, or arrangements in the coal price-fixing scheme.

Keywords: Energy policy; coal liquefaction; linkages; multiplier; linear programming

1. Introduction

Oil plays an important role in the Indonesian economy, as a source of fuel, raw materials for production, and as an export commodity which to date still represents a significant source of government income. Indonesian dependence on oil in the long term may harm the sustainability of economic growth. As a matter of fact, in recent years Indonesia has become a net importer of petroleum.

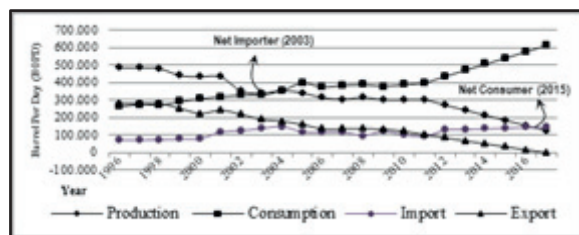
Meanwhile, Indonesia also possesses up to 105.2 billion tons of coal resources, of which approximately 21.1 billion tons are reserves. Of these resources, approximately 20.2% (21.25 billion tons) is low-rank coal (BadanGeologi, 2012). If each ton of this low-rank coal is converted to two barrels of synthetic oil, we would obtain

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42.5 billion barrels. (Daulay, 2008). This amount is 10.5 times the proven oil reserves of Indonesia, which is currently at 4.04 billion barrels (January 2011).

CSO as an alternative fuel would greatly save Indonesian foreign exchange reserves, considering that since 2003 Indonesia has become a net importer of oil, and is posed to become a net consumer of oil by 2015 if no new reserves are found (Figure 1).



Source: DitjenMigas 2012 and reprocessed

Figure 1. Crude Oil Supply and Demand (Barrel/BOPD)

Indonesia in cooperation with Japan (NEDO) has conducted several feasibility studies regarding the development of liquefaction plants which utilize Improved-Brown Coal Liquefaction (I-BCL). The resulting product from I-BCL is synthetic crude oil, with characteristics similar to petroleum. Through fractionation and purification, this crude oil can be converted to gasoline, kerosene, diesel and other chemical products (Huda, 2008). Refer to Table 1.

Table 1. The product specification of coal liquefaction (I-BCL)

Fuel Type	Unit	I-BCL Products	Industry Standard	
			Indonesia	Japan
Gasoline:				
-Octane Number		Min. 90	Min. 88	Min. 89
-Sulfur Content	Wt %	Max. 0.005	Max. 0.2	-
Kerosene:				
-Smoke point	Mm	Min. 16	Min. 16	Min. 23
-Sulfur Content	Wt %	Max. 0.005	Max. 0.2	Max.0.015
Gas Oil:				
-Cetane Number		Min. 45	Min. 45	Min. 45
-Sulfur Content	Wt %	Max. 0.005	Max. 0.5	Max. 0.2

Source: PuslitbangTelmira

The results of the feasibility studies conducted in PT Arutmin, Mulia, Kalimantan Selatan and PT Pendopo Energy Coal, Sumatera Selatan show that the economic levels of a liquefaction plant is influenced by the quality of the coal used as its raw material (Refer to Table 2 and 3).

Results from economic analysis found that with an assumed coal price of US\$60/ton, CSO selling price of US\$111/bbl and interest rate (i) of 5%, investment in larger-capacity CSO plants will give better Internal Rate of Return (IRR), Profitability Index (PI) and Payback Period compared to smaller-capacity plants.

Table 2. Feed coal characteristics of coal synthetic oil pilot plant

Quality Parameter	Mulia	Pendopo
• Total Moisture (ar)	35.00%	55.00%
• Proximat analysis (adb)	23.00%	15.90%
- Inherent Moisture	3.90%	7.80%
- Ash	38.10%	44.80%
- Volatile matter	35.10%	31.60%
- Fixed carbon	0.15%	2.50%
- Total sulphur		

Source: Huda, 2008

Table 3. Analysis result of financial aspect of coal synthetic oil plant

Plant Capacity	IRR (%)	NPV (US\$)	PI	Payback Period (Year)
Mulia Coal:				
• 3000 (t/d)	5.78	158,186,264.13	1.11	17.98
• 6000 (t/d)	7.06	876,090,838.51	1.37	13.02
• 12.000 (t/d)	9.17	2,746,042,296.88	1.66	9.98
Pendopo Coal:				
• 3000 (t/d)	0.43	-769,597,990.71	0.49	56.71
• 6000 (t/d)	3.23	-567,477,287.41	0.77	29.29
• 12.000 (t/d)	4.70	-176,190,295.91	0.96	21.95

Source: Huda, 2008 and reprocessed

2. Research Methods

This study aims to quantify the economic impact of the utilization of low-quality coal through coal liquefaction process using an Input Output model based on the Indonesian Input-Output Table table for the year 2005, 175x175 sectors, domestic transactions on the basis of producer prices (BPS, 2005).

This table is projected until the year 2025 by entering including the low-rank CSO sector as a new classification. The projection is carried out in two assumptions that are Scenario 1 (S_1 , low) with an economic growth of 6% and Scenario 2 (S_2 , high) with 7% in 2010-2015 and 8% in 2015-2025 (MP3-EI, 2011). Final demand is projected based on regression analysis, while optimization was performed using using linear programming.

The yield of the CSO sector allocated to meet intermediate and final demands is 80.5 million barrels (BP-PEN, 2006-2025). The value of goods and services used as inputs in the production of CSO are based on the results of a feasibility study of coal liquefaction plant (Huda, 2008).

3. Analysis of the Input-Output Model

3.1. Input-Output Model Definition

An Input-Output Table is a comprehensive and consistent data set, detailed in statistical descriptions in the form of a matrix that shows the structure of an economy's entire production system over a particular period of time, usually a calendar or financial year. It shows the goods and services produced by each industry, how such goods and services are used by different users; whether as intermediate inputs in production or for final consumption.

3.2. Relationship of the entries in the I-O table

The relationship between the entries in IO Table and GDP are as follows:

$$\sum_j X_{ij} + Y_i - M_i = X_i \quad (i = 1, 2, \dots, n) \quad (1)$$

Where:

X_{ij} = transactions from i sector to j sector,
 Y_i = final demand of i sector,
 M_i = imports of i sector,
 X_i = total output i sector.

$$\sum_i X_{ij} + V_j = X_j \quad (j = 1, 2, \dots, n) \quad (2)$$

In this case V_j is the primary inputs (added value) of j sector. Because $X_i = X_j$, the formula can be written as follows:

$$\sum_j X_{ij} + Y_i - M_i = \sum_i X_{ij} + V_j \quad \text{or } Y_i - M_i = V_j \quad (3)$$

In the IO table, technical coefficients (a_{ij}) are used to measure the input requirements per unit of product. These coefficients are defined as the ratio between the outputs of sector i used in sector j (X_{ij}) and the total input of sector j (x_j) is determined as follows:

$$a_{ij} = \frac{X_{ij}}{X_j} \quad \text{or } X_{ij} = a_{ij} \cdot X_j \quad (4)$$

Output in the IO models is calculated using the following equation:

$$(I - A)X = Y \quad ; \quad X = (I - A)^{-1} Y \quad (5)$$

In the equation written above, $(I - A)^{-1}$ is the inverse matrix from $(I - A)$, also called the Leontief inverse matrix (Bulmer, 1982).

3.3. National Output Projections

Output in the economy of a country in the IO model as developed by Bulmer can be calculated as follows:

$$X = (I - A)^{-1} Y \quad (6)$$

Where:

Y = final demand,
I = identity matrix,
A = technical coefficient;

The Leontief inverse matrix $(I - A)^{-1}$ is very important for analyzing the economy because it is inter-related with the level of final demand towards the estimation of production rate. Changes in industry output can be predicted using the Leontief inverse matrix.

3.4. Intersectoral Linkages Analysis

This analysis is used to understand the impacts on the output of a sector as a result of changes in the final demand for each sector of the economy. The impact of industrial linkages between sectors can be observed through backward and forward linkages. Backward linkages of a sector with other economic sectors in a region/country (Bulmer, 1982) are calculated with the following formula:

$$\alpha_j = \frac{(1/n) \sum_i b_{ij}}{(1/n^2) \sum_i \sum_j b_{ij}} \quad (7)$$

Whereas a sector's forward linkage with other sectors is calculated as follows:

$$\beta_i = \frac{(1/n) \sum_j b_{ij}}{(1/n^2) \sum_i \sum_j b_{ij}} \quad (8)$$

3.5. Multiplier Analysis

Multiplier analysis is used to understand changes in the endogenous variables, which is sectoral output as a response to changes in exogenous variables such as final demand (Nazara, 2005). The results of this analysis are used to set targets and allocate development.

4. Linear Programming Approach to Input-Output Model

Linear programming in IO models is a mathematical model for utilizing the limited resources to meet the desired objectives optimally in the scope of input and output sectors.

The projected value in the IO table is not necessarily the optimal value, thus it will be optimized using linear programming with the objective function to maximize the final demand (Y_i) and total output ($X_i=X_j$) in IO Table 2025 (coefficient of objective can be seen in Table 4 and Table 5).

This linear program uses five decision variables: the coal mining sector, CSO, natural gas and geothermal mining, petroleum refineries products, and other sectors which are a combination of 21 other economic sectors.

The limiting functions for each economic sector are import and primary inputs (added value) which indicate the degree of remuneration of the factors of production, which consist of employee salary, operating surplus, depreciation, indirect taxes, and subsidies (See Table 6 and Table 7).

The linear programming model is formulated as follows:

Maximize:

$$Z = \sum_i \Delta Y_i = \sum_j (I - A) \Delta X_j; \quad \text{and} \\ Z = \sum_j \Delta X_j = \sum_i (I - A)^{-1} \Delta Y_i$$

Subject to constraints:

Capital: $\sum k_j X_j - D_h \leq K_h$

.....

Labor: $\sum l_j X_j - E_h \leq L_h$

Operating surplus: $\sum s_j X_j - R_h \leq S_h$

Indirect tax: $\sum t_j X_j - P_h \leq T_h$

Subsidy: $\sum b_j X_j - F_h \leq B_h$

Impor: $\sum m_j X_j - I_h \leq M_h$

Nonnegativity: $X_1 \geq 0, X_2 \geq 0, \dots, X_n \geq 0$

Where:

k_j = capital coefficients;	b_j = subsidy coefficients;
K_h = available capital;	B_h = available subsidy;
l_j = labor coefficients;	t_j = indirect tax coefficients;
L_h = available labor;	T_h = available indirect tax;
s_j = operating surplus coef.	m_h = impor coefficients;
S_h = available surplus;	M_h = available impor;
$D_h, E_h, R_h, F_h, P_h, I_h$ = disposal activities.	

5. Impact of the Coal Synthetic Oil Sector on the Economy

5.1. The Economics of Coal Liquefaction Plants

Pendopo coal, which has higher moisture content than Mulia coal, results in more feed which is followed by an increase in the volume of the equipment at the upstream plant, such as coal handling, water removal, and boiler design. The location of the coal liquefaction plant in Pendopo also requires the availability of 200 km of pipelines to the port in order to transport CSO products.

Thus, the cost of procurement and construction of Pendopo plant which was calculated based on the results of a feasibility study in 2002, assuming a price increase of around 3.5%/year, would be U.S.\$98 million higher than the Mulia plant. The operational costs of Pendopo coal liquefaction plant on the same coal price assumptions (US\$60/ton) would be higher (US\$88.65/bbl) than the Mulia plants (US\$ 67.62/bbl).

Economic calculation of the CSO plant found that the value of IRR is less than 10%, making it less attractive to

investors. The value of IRR is influenced by the price of coal, product selling prices, interest rates, and the amount of taxes imposed on the company.

CSO plants should be built as an integrated industry of mining and coal liquefaction to improve productivity and efficiency. The government can also regulate low-rank coal prices to ensure stability of supply and price. Investment in CSO plants would be more attractive to investors if the government can provide incentives, such as:

- Reduction of coal production sharing (DHPB) and royalties;
- Reduction in corporate tax rates (PPH);
- Exemption of import duty for imported capital goods;
- Elimination of value added tax (PPN);
- Price subsidies.

5.2. Linkages Analysis

The impact of linkages is an important analytical tool for describing the role of the production sector in the structure of the economy and set the key sectors in development planning.

The results of backward linkage analysis (α_i) found that in general, energy provider sectors give lower yields than other economic sectors. However, the CSO sector is known to have higher backward linkages ($S_1:\alpha_3=0.942$ and $S_2:\alpha_3=0.958$) than the petroleum refineries products sector ($S_1:\alpha_{12}=0.679$ and $S_2:\alpha_{12}=0.674$) and other energy providers. Meanwhile, forward linkages (β_i) indicate that the CSO sector has a lower value ($S_1:\beta_3=0.731$ and $S_2:\beta_3=0.734$) compared to the petroleum refineries product sector ($S_1:\beta_{12}=1.333$ and $S_2:\beta_{12}=1.336$) and other energy providers.

5.3. Multiplier Analysis

Multiplier analysis was carried out in an open method (Type I), which does not include household consumption as one of the sectors of production, rather considering it an exogenous factor that does not determine the output of the economy.

5.3.1 Output multiplier

The output multiplier of CSO sector based on IO table in 2025 under scenario 1 and 2 are 1.505 and 1.528. This means that each increase in final demand (ΔY) in this sector of IDR1 billion will yield an output (ΔX) of IDR1.505 billion and IDR1.528 billion, respectively.

The output multiplier of CSO is higher than the coal mining sector ($S_1:OM=1.279$ and $S_2:OM=1.275$), natural gas and geothermal mining ($S_1:OM=1.159$ and $S_2:OM=1.157$), and petroleum refineries product ($S_1:OM=1.085$ and $S_2:OM=1.075$).

This indicates the ability of this new sector in creating a new output for the economy higher than the other energy providers.

5.3.2 Income multiplier

Income multiplier of CSO sector in scenario 1 and 2 are 3.85 and 4.60, which means that any increase in final demand (ΔY) of IDR1 billion will increase the total revenue (ΔN) of the entire economy of 3.85 and 4.60 times than before.

The income multiplier of this sector is higher than the natural gas and geothermal mining sector ($S_1:NM=1.94$ and $S_2:NM=1.94$), petroleum refineries products ($S_1:NM=1.58$ and $S_2:NM=1.66$), and coal mining ($S_1:NM=1.37$ and $S_2:NM=1.36$).

This shows the potential of this sector in creating household income due to the absorption of labor in meeting its production.

5.3.3 Surplus multiplier

Surplus multiplier of CSO sector based on IO table in 2025 on scenario 1 and 2 are 1.019 and 1.216. This means that any investment in this sector amounted to IDR1 billion would generate a surplus from operations of IDR1.019 billion and IDR1.216 billion.

The value of surplus multiplier is lower when compared to the natural gas and geothermal mining ($S_1:SM=3.953$ and $S_2:SM=3.961$), coal mining ($S_1:SM=1.803$ and $S_2:SM=1.807$), and petroleum refineries products ($S_1:SM=1.222$ and $S_2:SM=1.376$).

This indicates that the development of CSO plant in Indonesia provides enough surplus value for its investors.

5.3.4 Investment multiplier

Investment multiplier of CSO sector in scenario 1 and 2 of 1.242 and 1.333, which means that any increase in investment (ΔI) IDR1 billion, causing an increase in national income (ΔY) amounting to IDR1.242 billion and IDR1.333 billion.

This investment multiplier is higher than coal mining sector ($S_1:IM=1.392$ and $S_2:IM=1.385$), natural gas and geothermal mining sector ($S_1:IM=1.263$ and $S_2:IM=1.260$), and petroleum refineries product sector ($S_1:IM=1.036$ and $S_2:IM=1.036$).

This means that investment in the CSO sector will have a direct impact on national income equivalent to the other energy providers.

5.3.5 Value added multiplier

The value added multipliers of CSO under scenario 1 and 2 are 1.527 and 1.545 respectively, which means that any increase in final demand (ΔY) of a sector IDR1 billion will be able to move the economy and generate added value in other economic sectors as much as IDR1.527 billion and IDR1.545 billion.

The value added multiplier of CSO sector is higher than the petroleum refineries products ($S_1:VM=1.119$ and $S_2:VM=1.118$), natural gas and geothermal mining ($S_1:VM=1.149$ and $S_2:VM=1.149$), and coal mining ($S_1:VM=1.195$ and $S_2:VM=1.192$) sectors.

5.3.6 Employment multiplier

The Employment multiplier of synthetic coal oil sector in scenario 1 and 2 are 1.424 and 1.925, which means that any increase in final demand (ΔY) in this sector of a unit of money, would drive the economy and absorb labor in other sectors amounted to 1.424 and 1.925 units.

The employment multiplier shows a higher value than coal mining sector ($S_1:LM=1.294$ and $S_2:LM=1.290$), natural gas and geothermal mining sector ($S_1:LM=1.279$ and $S_2:LM=1.275$) and petroleum refineries products ($S_1:LM=1.036$ and $S_2:LM=1.036$).

6. The Role of Coal Synthetic Oil in the Economy

Plans for CSO plant development in 2025 is expected to contribute to national economic output of IDR65.033 trillion in scenario 1 and IDR82.226 trillion in scenario 2, or 0.33% of the total output (X).

Output of petroleum refineries products sector (X_{12}) in 2005 amounted to IDR148.086 trillion, while in 2025 under scenario 1 of IDR448.409 trillion and scenario 2 of IDR566.686 trillion. In percentages, the contribution of X_{12} to X declined, from 2.6% in 2005 to 2.26% in 2025 under scenario 1 and 2.265% under scenario 2.

Contribution of the CSO sector to final demand (Y) in 2025 under scenario 1 is estimated at IDR7.537 trillion and in scenario 2 IDR9.419 trillion. The contribution of the CSO sector (Y_3) to Y is 0.063%.

The contribution of the petroleum refineries products sector to the final demand (Y) in 2005 amounted to 0.61% or IDR21.027 trillion.

In 2025 under scenario 1, the contribution of this sector to final demand is estimated at IDR52.278 trillion and IDR65.338 trillion under scenario 2. The average percentage of this sector to the final demand is about 0.44%

7. Input-Output Table Optimization

The synthetic coal oil sector is expected to play an important role in the national economy in 2025. The impact of the utilization of low-quality coal can be understood by looking at the value of output and final demand in the IO Table.

Optimization was performed on total output and final demand from the IO Table for the year 2025 under scenarios 1 and 2 on the five decision variables which represent the energy providers.

Examples of maximization formulation of final demand are (Y_i) as follows:

Objective Function:

$$Y = 0.816X_1 + 0.644X_2 + 0.862X_3 + 0.923X_4 + 0.589X_5$$

Constraints:

- Capital: $0.05X_1 + 0.12X_2 + 0.02X_3 + 0.09X_4 + 0.05X_5 \leq 1,005,800,909.34$
- Labor: $0.16X_1 + 0.01X_2 + 0.06X_3 + 0.22X_4 + 0.15X_5 \leq 3,086,439,072.51$
- Operating surplus: $0.54X_1 + 0.29X_2 + 0.74X_3 + 0.64X_4 + 0.27X_5 \leq 5,637,843,521.49$
- Indirect tax: $0.03X_1 + 0.17X_2 + 0.04X_3 + 0.01X_4 + 0.02X_5 \leq 395,956,904.61$
- Subsidy: $0.00X_1 + 0.00X_2 + 0.00X_3 - 0.36X_4 - 0.00X_5 \leq -204,058,195.92$
- Impor: $0.03X_1 + 0.05X_2 + 0.00X_3 + 0.32X_4 + 0.10X_5 \leq 1,974,857,337.18$

The optimization results in Table 8 show that the impact of the CSO sector to the national economy in final demand (Y) has a smaller value than the actual value, while the optimization results for total output (X) indicate that the optimal output has a greater value than the actual value.

8. Conclusion

The conclusions that can be drawn from the above analysis are as follows:

- 1) The economic calculations of CSO plant development indicate profitable investment prospects. The analysis results found that under the assumed coal price of US\$60/ton, synthetic coal oil price of US\$111/bbl, and the interest rates (i) 5%, investment in CSO plants of larger capacity, for example, 12,000 tons of coal/day will give a better Internal Rate of Return (IRR) and Profitability Index (PI).
- 2) The result of backward linkage (α_j) analysis of the CSO found that it can only give a lower yield ($S_1: \alpha_3 = 0.942$ and $S_2: \alpha_3 = 0.958$) than the average backward linkages among sectors of the economy, but higher than the petroleum refineries products ($S_1: \alpha_{12} = 0.679$ and $S_2: \alpha_{12} = 0.674$) and others energy providers. One reason for this is the domination of national coal resources, which is the source of raw materials for the CSO industry, by large mining companies. The forward linkages (β_i) of the CSO sector is lower ($S_1: \beta_3 = 0.731$ and $S_2: \beta_3 = 0.734$) than other energy providers, indicating a lack of ability to encourage the growth of downstream sectors.
- 3) Multipliers of the CSO sector generally show higher average values than petroleum refineries products. These values indicate that the synthetic coal oil sector has the potential to create new output capable of driving the economy equivalent to petroleum refining and other energy providers. However, this sector has a surplus multiplier value lower than other energy providers, indicating that CSO plant investment is less able to provide operating surplus that is attractive to investors.
- 4) The government can provide incentives for the investment of low-rank CSO plant to make it more attractive to investors. Example forms of incentives that can be given are regulatory support, financial support, tax incentives/tax holidays, price subsidies, etc.

- 5) The results of final demand optimization in 2025 IO Table are lower than actual values due to such:
- a) The value of final demand ($Y=GDP$) in 2025 is estimated to have reached the optimal value;
 - b) CSO plants is more efficient than petroleum refineries as it uses domestic low-rank coal and is located close to the mine site;
 - c) CSO has an ability to attract more economic growth in the upstream sectors than the downstream sectors.

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Table 4. Objective Function Coefficient of IO Table in Scenario 1

No.	Sector	Final Demand (Y)	Total Output (X)
1	Coal Mining	0.815679	1.282149
2	Coal Synthetic Oil Industries	0.644245	1.520398
3	Natural Gas and Geothermal	0.861802	1.221582
4	Oil Refinery	0.923090	1.128445
5	Other sectors	0.588596	1.671504

Source: 2025 IO Table in Scenario 1

Table 5. Objective Function Coefficient of IO Table in Scenario 2

No.	Sektor	Final Demand (Y)	Total Output (X)
1	Coal mining	0.815679	1.282249
2	Coal synthetic oil	0.631941	1.556405
3	Natural gas and geothermal mining	0.861802	1.221644
4	Petroleum refineries product	0.923116	1.128440
5	Others	0.588471	1.672003

Source: 2025 IO Table in Scenario 2

Table 6. Minimum limit Coefficient of Primary input (Scenario 1)

No.	Sector (Constraint)	Coal mining	Coal Synthetic Oil	Natural Gas and Geothermal Mining	Petroleum refineries product	Others
1	Capital	0.04763	0.12057	0.02302	0.08838	0.04989
2	Labor	0.16092	0.00664	0.05645	0.22337	0.15545
3	Operating Surplus	0.54171	0.29297	0.73684	0.64457	0.27001
4	Indirect Tax	0.03359	0.17407	0.04176	0.00641	0.01948
5	Subsidy	0.00000	0.00000	0.00000	-0.36055	-0.00223
6	Impor	0.03184	0.05000	0.00373	0.32091	0.09601

Source: direct coefficient of 2025 IO table in scenario 1

Table 7. Minimum limit Coefficient of Primary input (Scenario 2)

No.	Sector (Constraint)	Coal mining	Coal Synthetic Oil	Natural Gas and Geothermal Mining	Petroleum refineries product	Others
1	Capital	0.04763	0.09536	0.02302	0.08838	0.04989
2	Labor	0.16092	0.00525	0.05645	0.22338	0.15556
3	Operating surplus	0.54171	0.23171	0.73684	0.64459	0.26972
4	Indirect tax	0.03359	0.24962	0.04176	0.00641	0.01944
5	Subsidy	0.00000	0.00000	0.00000	-0.36056	-0.00223
6	Import	0.03184	0.05000	0.00373	0.32091	0.09609

Source: direct coefficient of 2025 IO table in scenario 2

Table 8. The projection result offinal demand (Y) and totaloutput (X) (Trillion Rupiah)

No	Sector	2005	IO Table in 2025 (Scenario 1)		IO Table in 2025 (Scenario 2)	
			Actual	Optimal	Actual	Optimal
1	Final Demand	3,443.895	11,896.839	11,167.340	15,019.635	15,019.570
2	Total Output	5,688.274	19,813.284	32,727.790	25,022.737	41,350.150

Source: optimization result of IO table using linear programming